GRIFFITH, (J.P.C.)

RUBELLA

(RÖTHELN; GERMAN MEASLES)

WITH A REPORT OF 150 CASES

BY

J. P. CROZER GRIFFITH, M.D.

ASSISTANT PHYSICIAN TO THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA

SURGEON GENERAL'S OFFICE
325
LIBRARY

Reprinted from THE MEDICAL RECORD, *July 2d and 9th*, 1887

NEW YORK
TROW'S PRINTING AND BOOKBINDING CO.
201–213 EAST TWELFTH STREET
1887

RUBELLA

(RÖTHELN; GERMAN MEASLES)

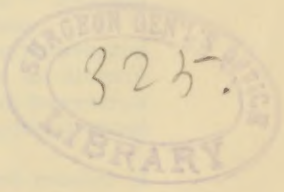
WITH A REPORT OF 150 CASES

BY

J. P. CROZER GRIFFITH, M.D.

ASSISTANT PHYSICIAN TO THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA

Reprinted from THE MEDICAL RECORD, *July 2d and 9th*, 1887



NEW YORK
TROW'S PRINTING AND BOOKBINDING CO.
201–213 EAST TWELFTH STREET
1887

RUBELLA

(*ROTHELN: GERMAN MEASLES*).

With a Report of One Hundred and Fifty Cases.[1]

By J. P. CROZER GRIFFITH, M.D.,

ASSISTANT PHYSICIAN TO THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA.

The recognition of rubella, although usually such an easy matter, is at times attended with difficulties so great that many physicians still refuse to believe in its independence. Even those who admit its existence give the most varied descriptions of its symptoms. Yet the earliest possible recognition of the disease in any case is often of the greatest importance to the well-being of the patient and of other individuals in the same house. The physician's error in diagnosis may be the means of spreading measles or scarlatina throughout a family or an institution.

I shall attempt, in considering the subject, to give, without much comment, the statements of many of the numerous writers whom I have consulted; and shall endeavor finally to draw from the literature, and from the cases reported here, some reliable conclusions concerning the description and diagnosis of the disease in question. Those who are interested in the matter will admit, I feel sure, that the confusion which exists is sufficient reason for another contribution on the disease.

The literature of rubella is already very extensive, and it has been impossible for me to make even an attempt at a complete bibliography. I shall append, however, a list of those writers (upward of 120 in number) whose publications I have been able to consult.

The cases upon which this paper is based number in all about 150. One-third of these occurred in my own

[1] I have made no reference anywhere to the valuable paper of Atkinson (American Journal of the Medical Sciences, January, 1887), because my own paper had been completed, in December, 1886, before his appeared.

practice, during the early months of 1886; the notes of 34 others, treated in the same year have been kindly furnished me by Dr. George E. Shoemaker; and Dr. J. H. Musser also has placed at my disposal those of nearly 70 cases observed by him in 1881, but never reported.

NAME.—The disease has been variously named and misnamed in different languages. Among these titles we find rubeola, rubeola sine catarrho, r. notha, r. epidemica, r. morbillosa, r. scarlatinosa, rosania, roseola, roseola epidemica, rubella, rosalia, rosalia idiopathica, scarlatina morbillosa, scarlatina hybrida, morbilli scarlatinosi, rötheln, feuer masern, roséole, roséole idiopathique, rubéole, rougéole fausse, German measles, French measles, false measles, bastard measles, hybrid measles, bastard scarlatina, etc.

The term "rubeola" is largely applied to it in Germany and in France (rubéole); but as it is the name often used for measles in English-speaking countries, it is best to avoid it. There is no reason why we should adopt the German word "rötheln," which is usually mispronounced, and for whose proper pronunciation, indeed, we have no equivalent vowel-sound in English. "Roseola" is a generic word whose employment here only adds to the confusion. As it seems best, then, to use some other name, I shall employ the term "rubella," advocated by Veale in 1866, adopted by Squire, and used as the reference-word in Dunglison's "Medical Dictionary." This word, too, being a diminutive of rubeola, expresses at once the usually slight import of the disease, and its relationship to measles—akin to that existing between varicella and variola.

HISTORICAL SKETCH.—How long rubella has been in existence is impossible to determine. Some writers are of the opinion that it was known to the Arabian physicians under the name of "Hhamikah," and by them considered a form of measles. Descriptions of a variety of this disease, which it is claimed was identical with rubella, were also given by Ingrassias, Ballonicus, and Sennertus in the seventeenth century. But up to the accounts published in Germany by De Bergen in 1752 and Orlow in 1758—unless we accept the publication of F. Hoffmann in 1740—there seems to have been no attempted recognition of a third distinct and specific eruptive fever different from both measles and scarlatina.

Germany.—Taking a hasty review of the history of the disease in Germany, we find a report by Selle, in

1780, of a very malignant epidemic. Ziegler in 1788, Formey and Fielitz in 1796, Sprengel, Stark, and others also maintained its specific nature and reported epidemics. It was generally considered a serious and often fatal malady. Formey stated that between the years 1784 and 1796 1,180 persons died of it in Berlin; while during the same interval there were but 203 deaths from scarlatina and 103 from measles. The descriptions given by these authors vary considerably. The writer last quoted reports the disease as beginning in the throat, where a white coating was often found. Vomiting and severe nervous symptoms—as coma and delirium—were not uncommon. Selle describes the eruption as consisting of miliary pustules. Others, again, write of a universally diffused, flaming-red rash, followed by a desquamation of large scales, and sometimes by dropsy. There were, however, many physicians who did not believe in its independent existence. Göden (1822) confounded it with scarlatina; Jahn (1835) denied its existence entirely; Hufeland, Frank, Reil, Heim, and others considered it a form of scarlatina, although Heim gave a description of the eruption much as we now find it in rubella. This opposing view gained the upper hand for a number of years. The fact nevertheless remained that there did exist an eruptive fever having a benign course and a characteristic eruption, and which could not be classified with either measles or scarlatina. To get rid of this stumbling-block, Hildenbrand, as early as 1825, and Schönlein, in 1832, had maintained that rubella was a hybrid of the other two fevers. This opinion, or the view of the disease as a transitional form, gradually supplanted other theories. It was shared by Geertsema (1821), Busche (1841), Paasch (1854), Gelmo (1858), and many others. Many interesting instances were reported, seeming to uphold it. It was claimed that the malady prevailed at the same time with both scarlatina and measles; or while an epidemic of the one was on the wane, and one of the other increasing in severity. Epidemics of rubella frequently occurred, too, in localities lying between two districts, in one of which measles was to be found, and in the other scarlatina. I have only space to quote from two of these publications. Paasch attended in families where typical measles first appeared; then cases characterized by very little fever, an eruption of small red spots, and slight sore throat; and, following these, others of an undoubtedly scarlatinal nature, accompanied by

marked anginose symptoms. One of the most interesting accounts, purporting to show the influence of scarlatina and measles upon each other, and the non-existence of rubella as a specific disease, is that by Gelmo. He reports epidemics of the first two diseases, occurring at various times between the years 1848–53, inclusive, and describes cases illustrating a transitional form between them. In 1853, for example, the last patients of an almost exhausted epidemic of scarlatina showed an eruption which was but poorly developed, consisting of minute spots or of patches the size of the hand. The incoming epidemic of measles, which immediately followed, presented, besides the ordinary catarrhal symptoms, inflammation of the tonsils and a confluent redness of the whole cutaneous surface. The cases of measles, which were observed later, ran a normal course.

The general opinion among physicians in Germany continued to tend toward the entire rejection of rubella as a disease *sui generis*. This was the view of Canstatt, Hebra, Gintrac, and others. But, in spite of all opposition, there were still many believers in the specificity of the third exanthema. Among these were Behrend (1828), Wagner (1834), Meissner (1844), and as time went on others were added to them. After 1860 the independent existence of rubella was maintained in Germany by Mettenheimer, Thomas, Hennig, Thierfelder, Vogel, Wunderlich, Lindwurm, Arnold, Gerhardt, Steiner, Kuster, Roth, Emminghaus, and many others, with Nymann in Russia, and De Man in Holland. This view is now held almost without exception. Strümpel says that the existence of rubella can only be denied by those who have never seen it.

England.—In England the question received but little attention until later years. Tripe claims that Fothergill in 1754 described rubella in his essay on a certain kind of malignant sore throat. A perusal of this paper renders it more than probable, however, that it was a form of scarlatina. Willan in 1808, and Bateman in 1813, described a roseola, and also a rubeola sine catarrho, which did not protect from measles. But Maton in 1815 was the first to recognize rubella as an affection distinct from either measles, scarlatina, or roseola. Nevertheless, the view that it was only an anomalous form or a hybrid prevailed in England also until 1840, when Paterson maintained that it was a dis-

ease *sui generis*, and gave a description of it, though as he described it the affection was certainly more severe than it now is. Tripe agreed with this in 1852, and Balfour in 1857. Later there prevailed a difference of views. Copland in 1858 claimed that it was a hybrid, and this was the belief of Aitken. Reynolds' "System of Medicine" (second edition, 1870) contains no notice of it; Watson scarcely mentions it. On the other hand, it is firmly believed in by Veale (1866), Murchison (1870), Liveing (1874), Dunlop (1871), and others. Among the numerous reports of epidemics during the last decade may be mentioned those of Cheadle (30 cases), Shuttleworth, Douglass (50), Tonge-Smith (145), Wilson, Dukes (63), and others; and that of McLeod from Calcutta. The specific nature of the disease is now usually admitted by English writers.

France.—In France the disease received less attention than in Germany. Its existence as an independent affection was disputed in the early part of the nineteenth century. Rayer in 1826 confounded it with roseola, and denied its specific character. Alibert (1832) recognized in it a distinct disease; called it "roséole idiopathique," in contradistinction to symptomatic roseola; and described its symptoms nearly as we know them. Barthez and Rilliet, in their edition of 1853, classified it with roseola; later, in 1861, they appear to recognize its independent nature, and say that it bears the same relation to measles as varicella does to variola. From this time the majority of writers in France, as in Germany uphold the distinctiveness of rubella. Although it is denied by Thore, it is maintained by Danis, Trousseau, Roger and Damaschino, Delastre, and others.

Italy.—My search after the history of rubella in Italy has been almost totally barren of success. In the Dictionary of Medical Terms, by Longhi and Tirinanzi (1882), no mention is made of it as a distinct disease. That it is, nevertheless, recognized by some modern writers is proved by the paper of Cuomo in 1884; but with this exception I have found almost no reference to it.

America.—Homans, of Boston, was the first to recognize rubella in this country, having seen and described cases in 1843. Cotting read a paper on the disease in 1853, and published an account of a series of cases in 1871. Caleb Green, too, in the same year stated that he had witnessed an epidemic. In 1874, J. Lewis Smith brought the disease prominently before American physi-

cians, and since that date a great number of communications have been published. Many epidemics of considerable size have been reported; among them those of Hatfield (110 cases), Park (over 100), Earle (120), Edwards (166), and Kingsley (21).

RUBELLA AN INDEPENDENT DISEASE.—We have seen, then, how rubella, at first looked upon with suspicion or utterly denied being, has at last won an established place for itself, although there are still some quite recent writers who are disposed to deny its separate existence. Henoch, for example, almost repudiates it; Fagge, in his "Practice of Medicine," recently issued, says that the only reason for the admission of rubella as a distinct disease is that "it explains the occasional supervention of what appears to be a second attack of measles in the same individual. But," he continues, "the importance of this argument may be easily overrated." Goodhart thinks it can be a hybrid as well as a distinct disease. Descroizilles does not recognize it at all. Two of those partaking in the discussion at the International Medical Congress in 1881 (Stewart and Oxley) did not believe in it, and I have met with several other dissentient views in the literature.

It would seem, then, not unnecessary to formulate some of the propositions upon which the theory of the independence of rubella rests:

1. It is an epidemic and contagious eruptive fever, and not a simple affection of the skin.

2. It prevails independently of the existence of measles or scarlatina.

3. Its incubation, invasion, eruption, and symptoms differ materially from those of either of the other two fevers.

4. It attacks indiscriminately and with equal severity both those who have had measles or scarlatina and those who have not; nor does it protect in any degree from either of these diseases.

5. It never produces anything but rubella in those exposed to its contagion.

6. It occurs but once in the same individual.

Some of these propositions will be admitted without dispute, and do not need proof; others will be discussed incidentally later in the paper. The admittance of the truth of the 4th is alone sufficient to establish the existence of rubella as a distinct disease, unless we admit that measles and scarlatina are very likely to occur a second

time in the same person. But this is contrary to the universal experience and belief. Were it a hybrid of the two, or a variety of either disease, so modified that it could not protect *fully* from the typical disorder, we would with reason expect, on the one hand, that rubella would be more severe in those individuals who had never had measles or scarlatina; and, on the other hand, that the previous occurrence of rubella would greatly modify the virulence of the other affections. But it is, I think, almost uncontested that the three diseases have no protective power whatever upon each other.

Again, the disease often prevails at a time when both or one of the other two are not epidemic. This statement expresses the views of those who have studied rubella excepting the older writers, who certainly often confounded the three affections.

That rubella does frequently occur in those who have had measles and scarlatina is proved by the evidence of various writers, as seen in the following statement:

Of J. L. Smith's 48 cases, 19 had had measles; of De Man's 33 cases, 10 had had measles, 4 scarlatina; of Thierfelder's 45 cases, 22 had had measles, 5 scarlatina; of Hatfield's 110 cases, many had had measles and scarlatina; of Shuttleworth's 27 cases, 15 had had measles and scarlatina, and 5 had both diseases in later years; of Klaatsch's 22 cases (first epidemic), 11 had had measles; of Klaatsch's 40 cases (second epidemic), most had had measles; of Dukes' 88 cases, 61 had had measles; of Cheadle's 30 severe cases, 22 had had measles.

Quite a number of the cases to be reported in this article had previously had measles, or developed it afterward.

It has been strongly urged against the existence of this fever that physicians are not agreed as to its symptoms; and that the severe disease described by the earlier writers, and even by Copland, Aitken, and others, is quite different from the trivial affection as it is now usually seen. Of the rubella of the older writers, Thomas says: "It is probable that much that has been described under this name [rubeola] was nothing more than measles or scarlet fever." This remark applies with equal truth, I think, to some of the severe cases and epidemics more recently reported. It is also to be borne in mind that rubella, like other contagious diseases, may vary greatly at different times and places; and, further, that very anomalous cases may occur. Still another possi-

bility exists, that, as Klaatsch and some others believe, the disease has become gradually modified, and much less severe, during the time which has elapsed since the first descriptions of it were published.

Etiology.—There is abundant proof that rubella is *contagious*, and this fact is now very generally admitted. It has been, however, doubted by many. Kassowitz, in his earlier writings, and Steiner deny it altogether; Slagle questions it; and De Man, Picot, Mettenheimer, Arnold, and Lindwurm only think it probable. Walch believes it may arise spontaneously, and says that epidemics of it appear in Malta as soon as the rainy season sets in. As to the *degree* of contagiousness, Thomas thought it somewhat less than that of measles; and Tonge-Smith, Liveing, Bourneville and Bricon, Hardaway, and others are of the same opinion. Squire, Chadbourne, and J. L. Smith say the disease is feebly contagious. Klaatsch thinks it is more so in some epidemics than in others; and Jacobi and Dukes consider it very contagious. My own experience leads me to believe that the contagious nature of rubella is very decided. Out of about 100 cases in a "Home" where I attended, 37 took the disease in spite of the most prompt and careful isolation. Out of approximately the same number in another institution, 26 were attacked. Thomas, Roth, Veale, and others think the disease is probably *infectious* also; Emminghaus believes that this is proved by cases reported by Balfour. Edwards states that the origin of many of his cases could be traced to infection from the bunks in ships.

Rubella occurs chiefly in *epidemics*, and most frequently in winter and spring. J. F. Meigs stated [1] that he considered it rather epidemic than contagious. This is, too, the opinion of Slagle. Liveing and Edwards deem it more prone to be so than is either measles or scarlatina; and Thomas emphasizes its epidemic nature. Whether it is a *cyclic* malady, as Thomas thinks probable, with a period of some years between its appearances in the community, can only be determined by further investigation.

Regarding the *stage* at which rubella is most easily communicated, there is little known, and opinions differ. Thierfelder believes it to be most contagious during the healing stage. Squire thinks it can be communicated

[1] Personal communication.

before the rash appears, and for a month after this date. The spread of the disease throughout an institution, despite prompt isolation of the affected children—as in some of my own cases—proves that it is certainly contagious in the early stages. The nature of the *materies morbi* is unknown. The manner in which it is conveyed is probably by exhalations from the skin and from the breath, as in the case of measles. The discovery by Edwards and Formad of micrococci in the blood of some cases is interesting, but, I believe, has not yet been confirmed. There is no reason to believe that rubella ever imparts any disease but itself; and it is almost universally admitted that it occurs but once in the same individual. Trousseau, Picot, and Bourneville and Bricon are among the very few disposed to deny the latter statement; and Trousseau says, too, that an attack may be repeatedly induced by high temperature and by copious perspiration.

Sex appears to be without influence upon the occurrence of the disease.

Rubella is an affection of *childhood*, occurring especially between the ages of five and fifteen years. I have seen it in children under two years of age and Scholl reports it in an infant a few days after birth, the mother having had it two months before. But early infancy is usually exempt. Adults are also attacked, though comparatively seldom.

Of 55 cases reported by Thomas (1868), 2 were adult; of 22 cases reported by Thomas (1872), 1 was adult; of 42 cases reported by Emminghaus, 2 were adult; of 19 cases reported by Roth, 1 was adult.

Although there were many adults connected with the institutions for children in which 100 of the cases here reported occurred, yet but 1 of the number was attacked.

Seitz reports the disease in a woman seventy-three years of age.

INCUBATION.—The larger number of my own cases occurred in an epidemic in one of the "Homes" already referred to, and this circumstance offered excellent opportunities for the careful study of the disease. The first case was that of a child who, to my certain knowledge, had been very ill with measles two years previously. While temporarily absent she was taken ill with rubella, and was one of the children most severely attacked. The rash appeared on February 24, 1886, on which day

she returned to the "Home." On March 1st, *i.e.*, five days after the first exposure, 2 children exhibited the eruption; and on the 3d it appeared in 3 others. On the 4th, *i.e.*, eight days from exposure, 7 more children were affected; on the 5th, 2; on the 6th, 5; and on the 7th, eleven days from the first case, 7. From this time on fresh cases appeared almost daily, but it was impossible to determine from which patient the disease was contracted. Isolation was practised at once in every instance. Contagion from any other source outside was of the greatest improbability. In this series, then, the shortest period of incubation was five days, and 28 cases developed within eleven days. Most of the cases under the care of Dr. Musser occurred in a Home for boys. One of the inmates who was employed in the city during the day (he was the only one ever leaving the Home) contracted rubella there, and six days from the first appearance of the rash upon him the first of the other children was taken sick. Here the period of incubation was almost certainly six days. There remains, nevertheless, an element of doubt, since the disease may be contagious before the eruption appears.

The incubative period occupies a much longer time according to many writers, and I have indeed seen cases in other epidemics where this stage was undoubtedly much more prolonged. Glaister gives the duration of incubation at four to five days, or longer; Robinson, six to seven days; Pollock, six to sixteen days; Edwards, six to twenty-one days (average, ten days); J. L. Smith, seven to twenty-one days; Bourneville and Bricon, eight to ten days; Squire, eight to twenty-one days (usually fourteen days); Hatfield, in 2 cases, definitely, ten days; Steiner, ten to fourteen days; Cheadle, definitely, eleven to twelve days, in 2 cases; Dukes, twelve to twenty-two days (average, fifteen to sixteen days); Duckworth, in one case known to be sixteen days; Cuomo, never less than seventeen days; Cullingworth, Balfour, and Tonge-Smith, two weeks; Goodhart, Jacobi, Hardaway, Mettenheimer, and Thierfelder, two weeks or longer; Gerhardt, Kassowitz, Emminghaus, Picot, and Eichhorst, two to three weeks; Thomas, Earle, and Klaatsch, two and one-half to three weeks; Cotting, about three weeks.

The above list has been made thus extended in order to show the very varying duration of the period. This is, indeed, one of the diagnostic marks of the disease, in contradistinction to the fixed period of incubation

of measles. The greater number of the writers quoted state it to be fourteen days or longer; but it may certainly last a very much shorter time.

There are no symptoms appearing regularly during the stage of incubation. Squire states that some complaint of the throat is occasionally made, and epistaxis and enlargement of the post-cervical glands may be noted.

Invasion.—Many of the cases reported here exhibited no prodromes at all. In a large number, however, slight symptoms were observable, not more than twelve hours before the rash made its appearance. There were malaise and generally decided drowsiness, and the eyes frequently became red and watery or had a heavy look. Sneezing was noticed, and there was often a slight cough. One case exhibited prodromal symptoms twenty-four hours, and another forty-eight hours, before the eruption appeared. The temperature during this stage was not recorded.

The testimony of the large majority of writers is, either that there are no prodromal symptoms whatever, or that they usually last but a few hours or a day and are of slight import. This is the opinion of Thomas, Klaatsch, Liveing, Hardaway, J. L. Smith, Brodie, Squire, Maton, Cotting, Bristowe, Day, and many others. Park, in over 100 cases, detected no symptoms during the invasion. Earle, in 120 cases, saw no prodromes in children, but frequently observed them in adults. Tonge-Smith, in 145 cases, found them absent or slight. The number and nature of the slight prodromal symptoms are variously described; but, from a comparison of very numerous published reports, it would seem that the symptoms which may be expected in a normal case are malaise, often slight cough, suffusion of the eyes, with perhaps some lachrymation, probably some coryza, sometimes pains in the limbs, drowsiness, at times hoarseness, sore throat often, enlargement of the glands at the back of the neck and behind the ears, possibly an elevation of temperature of 1° to 2° F., occasionally nausea, and some œdema of the face. But any or all of these may be wanting.

A number of writers differ from those mentioned in extending the usual duration of the stage of invasion. Many of these, however, admit that the prodromes may be absent or slight; while some of those already quoted concede the possibility of their lasting longer than twenty-four hours.

McLeod says that this stage lasts twenty-four to thirty-six hours; Murchison, that it may continue forty-eight hours or less; Binns puts it at two days; Mettenheimer, Henderson, Kingsley, Thierfelder, Emminghaus, Roth, one to three days; Copland, Cuomo, and Cheadle, two to three days; Cullingworth and Edwards, three days; Paterson and Aitken, three to four days; Lindwurm, four days; Hemming, a few hours to five days; Balfour, two to six days; and Claussen says that in some cases there is malaise for six to seven days.

The stage of invasion may be, then, without question prolonged, or its symptoms unusually severe; but, from the overbalancing mass of evidence upon the other side, I am inclined, with Hardaway, to adopt the view of Thomas—viz., that "a prodromal stage of more than, at most, half a day . . . constitutes an anomalous case."

Other prodromal symptoms are occasionally seen, but must be called unusual. Vomiting occurs rarely, according to J. L. Smith, Murchison, McLeod, and Emminghaus. Kingsley says it usually precedes the rash. Cuomo reports its presence in anomalous cases. I have seen it in but two instances. Convulsions are reported by J. L. Smith, Edwards, Lindwurm, Cuomo, and Alexander. Delirium, by Hardaway, Cuomo, and Edwards. Urticaria, by Cullingworth. Hemorrhages from the eyes and ears, by Prioleau. Epistaxis, by Edwards. Dizziness, by Squire. Fainting, by Mettenheimer. Croup-like attacks, by Balfour. Intense headache, by Cuomo. Nymann noticed rigors in 19 out of 119 cases. Emminghaus says they are found but seldom. This author and Thierfelder report the occurrence of a slight, cloudy redness immediately preceding the appearance of the rash; and Edwards reports erythema in 4 cases, and Cuomo in 7.

Eruption.—Following the slight prodromal symptoms, or without these, and in the midst of health, the eruption of rubella appears. Very often, as Thomas observes, the child is found covered with it after the night's sleep. There is some difference of opinion as to the part of the body which it attacks first, and the order in which it involves other parts. Most writers are agreed that, as a rule, it appears first on the face and spreads with great rapidity over the rest of the body (a few hours to a day), attacking the legs last. This is the opinion of Thomas, Emminghaus, Squire, Picot, Rilliet and Barthez, Metten-

heimer, Klaatsch, Bourneville and Bricon, and many others. Liveing and Morris claim that its first appearance is on the back and chest; Day, Murchison, and Balfour, that it is to be first seen on the breast and arms; and Paterson and Copland, that it develops all over at once. Park says that the eruption is often to be seen on the roof of the mouth before visible on the skin, and then appears on the neck. In the few cases in which I have been able to detect any sequence in the appearance of the rash it was visible first upon the brow and over the body of the lower jaw, thence shading off upon the neck. Indeed, in some cases it could be found at no time elsewhere. It is possible, as Emminghaus claims, that such cases are explained by the unobserved existence of the rash for a few hours upon other parts of the body. Heim, however, was of the opinion that there could be a local eruption, and there is reason to believe that this may occur. Reed described a case in which the rash was visible only on the tonsils and palate. In one of the cases included here it could be seen only upon the face and neck, although the attending symptoms were quite severe. In another instance the rash could be found only during a few hours and upon the brow, in spite of most careful inspection of other parts of the body.

The entire cutaneous surface may be attacked. J. L. Smith and Emminghaus except the soles and palms; but Thomas, Roth, and others mention its occurrence there, and some of the cases in this report exhibited it in these situations. Tonge-Smith claims that the rash invades the oral circle, and that this distinguishes it from scarlatina. Pathologically the eruption of rubella is defined by Thomas to be a hyperæmia of the papillary body and upper layer of the corium. In a typical case, such as were found in numbers in the epidemics reported here, it consisted of small irregularly shaped spots of pin-head to split-pea size, of a peculiar pale rose-tint, more or less sharply defined, and somewhat elevated both to the touch and to the sight. The spots are not arranged in groups, as in measles, are widely distributed, and more or less closely placed. They are usually discrete and separated by larger or smaller areas of healthy skin, but show a tendency to become confluent on certain parts of the body, particularly on the face and those parts kept warm and under pressure, as are the nates and the flexor surfaces of the thighs in bed.

On the trunk, and especially on the back, the rash is

usually paler or of a brownish-red color, fine, and very thick. On the wrists and ankles, and sometimes on the fingers and toes, the isolated papules are usually very evident. In this connection, to illustrate the influence of pressure, I may mention a case in which the eruption was particularly well developed in two circular bands, one around each leg, above the knee, where the garter had been worn. A similar band-like eruption upon the legs is mentioned by Klaatsch.

The above description is essentially that given by the majority of modern authors. But there is no doubt that the eruption is exceedingly variable—"multiform," as Duhring names it—and many of the descriptions vary accordingly. Not only does the rash differ in different epidemics, but in different cases in the same epidemic. Even in the same person two types of eruption may appear, as will be described later.

Heim says the rash resembles the appearance produced by dotting moist white paper with a quill pen dipped in red ink. This description is adopted by Paterson. But we can scarcely take into consideration the accounts of the rash given by the earlier writers, since it is very certain, as insisted upon by Thomas and Bourneville and Bricon, that the disease reported by them was very different from rubella as we know it.

In examining more particularly what has been said by modern writers upon the individual features of the rash, we find that Thomas describes its color as a pale rose-red, not so bright as the red of severe scarlatina, nor having the bluish-red tint of intense measles. Shuttleworth calls it a brownish-red. Aitken states that it is more elevated than in measles; Mettenheimer, that it is confluent upon the cheeks. The development of vesicles is extremely rare. I have found it noted by Curtman, Cuomo, Thomas, Hardaway, and Copland. Thomas, Gerhardt, and others say that the spots of rubella possess either smooth or indented edges, and are in the latter case often connected with each other by delicate processes. Emminghaus and Cuomo speak of a marbled appearance of the skin, and of small, delicate blood-vessels sometimes to be seen in the healthy portions. Petechiæ have been described by Dunlop and Cheadle, and a purpuric rash in one case by Glaister. Cheadle also says that the rash is darker, more purple, and more papular than in measles; but the epidemic which he reports was in many ways anomalous. Claussen noticed that

upon pressing upon the papules there was a sensation as of small shot beneath the skin. In this connection I may report an analogous case. The eruption covering the child on the first day was composed principally of *annular spots*, from the size of a pea to that of a silver three-cent. piece, of a pale rose-red color, with a distinct yellowish tinge in the centre. In most of these macules a distinctly hard, small, shot-like body could be felt beneath the skin. The annular appearance was very marked. Being somewhat at a loss regarding the exact nature of the eruption, I asked Dr. Van Harlingen to see the case with me, which he did upon the following day. Within the twenty-four hours, however, the rash had altered its nature so completely that there could be no longer any doubt that the disease was rubella.

According to Rilliet and Barthez, the rash may disappear and again appear upon the same day or later. I have seen one instance in which it was invisible during one day and returned. This phenomenon is, of course, not to be called a "relapse" of the disease.

In another patient of Dr. Musser's the rash could at first only be kept upon the cutaneous surface by the repeated use of hot baths. The symptoms in this case were severe.

There is some difference of opinion concerning the degree of elevation of the eruption. Thomas, Emminghaus, Mettenheimer, Wunderlich, Roth, and others say that the spots are slightly elevated. Hardaway, Cuomo, Duhring, and others describe the rash as macular. The multiform nature of the eruption accounts for these differences.

From a study of the cases reported here, there seems to me to be two easily recognizable *types* of variation from the character of the eruption in a normal case:

1. *Rubella morbilliforme.*—An eruption in which the spots are for the most part nearly or fully the size of a split-pea, more or less grouped, and, in fact, having the greatest resemblance to measles.

2. *Rubella scarlatiniforme.*—A rash which is confluent in patches or universally, not elevated, and which produces a uniform redness, closely simulating that of scarlatina. Careful examination often reveals a few papules amid the general diffuse redness. These can be best seen between the brows and on the wrists or fingers.

Other cases exhibit all gradations from the normal

type toward either of these extremes. The rule may perhaps be formulated, that the more macular the rash, the greater the disposition to confluence ; and the more distinctly papular, the greater the tendency to form measle-like groupings.

The existence of a scarlatinal and of a rubeoloid form of eruption in rubella forced itself upon my attention before reading the reports of somewhat similar observations by a number of writers. Harrison has remarked this same condition of affairs. Klaatsch maintains that an erythematous blush may extend over the skin between the spots, so that at first sight the disease resembles scarlatina. Copland says the eruption is usually discrete ; but in some cases is more diffuse, and may then be readily mistaken for scarlatina. He claims, however, that this redness fades after two days, while the spots remain. I have never observed any fading of the general redness in my own cases. Goodhart describes the rash as sometimes resembling measles and sometimes scarlatina ; while Byers reports a case in which it was scarlatinal in some parts of the body and rubeoloid in others. Picot and Henderson make a similar observation in a greater number of cases ; and Ladell reports three such, two of which developed scarlatina about six months later, and the other measles. Kassowitz states that the spots are sometimes large, elevated, and confluent, as in measles. Dukes says the rash may be a diffuse, rosy redness, or may be in spots as in measles. Murchison and Liveing state that the rash is in spots, but that these may coalesce and closely resemble scarlatina. The same observation is made by Tonge-Smith, who describes the eruption, which is at first in spots, as becoming "blurred" on the second day, and as then indistinguishable from scarlatina. The change in appearance produced by this "blurring" he compares to the effect produced by rubbing with the dry hand a series of dots made upon a slate with an ordinary slate-pencil. Hatfield describes an epidemic in which many of the cases could not be distinguished from measles, while the eruption in other patients was almost exactly like that of scarlatina. Kingsley states that the rash is often confluent, as in the latter disease ; and D'Espine, that it is often impossible to distinguish rubella from measles. J. L. Smith, too, writes that, although the rash is usually more like measles, an erythema sometimes extends over the skin, producing an appearance like that of scarlatina. One case he would have considered to be

mild scarlatina, had he decided only from the appearance of the rash. A very similar case occurred in my own practice. Although the eruption was at first macular on the face, yet on the second day it so closely resembled scarlatina that I was unable for several days to make a diagnosis. Not a single macule or papule could be found in the general scarlatinal blush which covered the whole body. The subsequent course of the disease proved that it could only have been rubella, and a short time afterward the brother of the patient was attacked. I have indeed repeatedly observed the change on the second day from the papular to a confluent, not elevated form, as described by Tonge-Smith.

Writers have been quoted here at perhaps too great a length; because, in spite of the facts, we find some of our best modern authorities (as Thomas in Ziemssen's "Cyclopædia," Bristowe, and others) stating or implying that rubella has no similarity to, and can scarcely be mistaken for, scarlatina. Bourneville and Bricon say it is astonishing that they could ever be confounded. It is, of course, generally admitted that rubella has usually a much closer likeness to measles. Thomas, while denying that the disease has any likeness to scarlatina, hints at the possible existence of another exanthem bearing a resemblance to scarlatina. Filatow, of Moscow, has recently gone further than this, and makes two distinct species of rubella, which he calls *rubeola scarlatinosa* and *rubeola morbillosa*—the latter being the one which we usually see, the typical rubella. He claims that they are entirely distinct affections, but does not offer sufficiently convincing proof of this. The evidence already given here shows, I think, that they are produced by the same contagion, and are consequently the same disease.

Other classifications of the eruption are sometimes made. Thomas, for example, describes three forms, depending on the size of the spots; Emminghaus speaks of a confluent and a discrete form; Nymann and Klaatsch, of a punctate variety and of one with large spots.

Although, then, there is a definite normal type of eruption in rubella, the numerous variations from this teach us that we must keep in memory the words of Maton, in 1815, the first English writer to recognize the disease: "But, after all, the true distinctions of this disease are, in my opinion, to be founded on the more general and constitutional circumstances."

Concerning the time the eruption persists upon different regions of the body, Thomas writes that it happens with tolerable frequency that the *maximum of the development of the eruption* on different parts occurs at different times. The rash is often at its height upon the face, neck, and upper portion of the trunk before it has appeared on the extremities; and when, after twelve to twenty-four hours, the acme is reached in the latter regions there remains often but little to be seen on the parts first affected. The duration of the most marked development of the eruption on any one locality is from a few hours to half a day. Hardaway goes further, and claims, with Emminghaus, Roth, and Mettenheimer, that this sequence of the maxima of the eruption upon different parts of the body is one of the safest diagnostic signs of rubella. The same feature has been noted by Squire and by Gerhardt. According to Emminghaus, this probably explains the difference in the views of writers concerning the seat of the first appearance of the eruption—*i.e.*, the rash may have already disappeared from the face when it is found apparently first upon the breast or elsewhere.

My own experience leads me to agree with Thomas, that this sequence of the maxima "happens with tolerable frequency." But I am not able to admit it as an important and safe diagnostic sign. I have nearly as often observed that the rash persisted with equal intensity on the face while it spread to the rest of the body, so that it could be said to reach its acme everywhere *upon the second day*. It then grew rapidly paler, either beginning on all parts at the same time or fading first from the face. Frequently it seemed to persist longest on those parts which had been the most affected, and was thus often visible on the face and nates after other regions were quite free of it. I have seen one instance, too, in which the order of the shifting maximum of Thomas was preserved, but was very much prolonged, the rash not reaching its acme upon the feet until the third day.

It is safe to infer that this absence of a universal maximum of the eruption has certainly not been confirmed by the greater number of writers, else some mention would probably be made of it, and we would not read that the "eruption reaches its height on the second day," as stated by Picot, Copland, Kingsley, Bristowe, Shuttleworth, Tonge Smith, Bourneville and Bricon, and

others; or on the third day, as Cheadle claims. These differences of opinion only show the tendency of the disease to vary.

The *total duration* of the rash upon the body is variously stated. It is given at half a day to one day (seldom three), by Gerhardt; one to two days, by Trousseau; two to three days, by Thomas, Alibert, Rilliet and Barthez, and Bourneville and Bricon; two to fifteen days, by Edwards; three days, by Claussen and J. L. Smith; two to four days, by Kingsley and Emminghaus; three to four days, by Maton and Picot; four days, by Hatfield; one to five days, by Klaatsch; four to six days, by Balfour; four to five days (in bad cases, six to ten), by Copland and Aitken; five to seven days, by Liveing; and in one case, fourteen days, by Alexander.

From a careful review of my cases, I find the rash lasted usually only two or three days; less often, four or five days. In some cases it had disappeared entirely within the first twenty-four hours.

Combining this with what seems to be most trustworthy from the various published accounts, its average duration may be said to equal *three to four* days; although it very often lasts a much shorter time, and may continue even longer.

Symptoms of the Eruptive Stage.—Either appearing with the eruption, or continuing from the stage of invasion when this was present, we find the symptoms of the disease. In the latter case they are simply the prodromes, often more or less intensified. Coming prominently into view is the combination of the catarrhal symptoms of measles with the angina of scarlatina, both, however, in a mild form. This has been noticed by many writers.

In the cases included in this article the most prominent of the *catarrhal symptoms* referable to the nose and eyes was a slight redness and suffusion of the latter. This was the most striking symptom in fully one-half the number of cases, and often even this was absent. In other instances there was sometimes sneezing and lachrymation; not often coryza, and rarely photophobia. A loose, bronchial cough was frequently present, and occasionally demanded treatment. The statements of authors regarding the intensity of the catarrhal symptoms correspond, for the most part, with the description I have given, although some are mutually conflicting and contradictory. Certain writers, as Trousseau and Reed,

deny the presence of catarrh ; others, as McLeod and Vogel, say there is usually none. According to Burnie, the absence of coryza and cough is a distinctive feature of the disease, but congestion of the conjunctiva is common. Brodie states that there is no sneezing ; Douglas that coryza is present in about one-half of the cases, and is less apt to occur than are other catarrhal symptoms ; Thomas, that conjunctivitis and sneezing are rarely absent, especially at the beginning of the attack ; Kassowitz, that there is catarrh of the eyes and of the nose and sneezing, but cough occurs in very few cases ; Wilson, that there is no bronchitis, and Cuomo, that it is usually present ; Klaatsch, that there is never marked photophobia or lachrymation ; Squire, that the eyes are diffused, and there is little or no coryza ; Cheadle says that croup-like cough is common, and that in one case this was so incessant that he was obliged to administer chloroform. Without doubt the severity of the catarrhal symptoms depends somewhat upon the epidemic, yet in nearly all cases it is very slight as compared with measles.

Sore throat is almost universally admitted to be characteristic of rubella, yet it is nearly always much less marked than in scarlatina. In the cases reported here it was invariably present, although generally slight, and the patient made no complaint of it. Examination, however, usually revealed redness of the mucous membrane, particularly marked at the upper portion of the anterior pillars of the palate. Sometimes the inflammation was quite severe, the tonsils were much swollen, and deglutition was painful. The occasional marked swelling of the tonsils, with difficult or impossible deglutition, and with profuse secretion of mucus, has been mentioned by many writers. I know of no writer who has not found sore throat generally present, except Parke, who limits "mild tonsillitis or pharyngitis" to twenty per cent. of his cases. Particular stress is laid upon its almost constant occurrence by Murchison, Liveing, Edwards, Burnie, Hemming, Aitken, Copland, Paterson, McLeod, and very many others. It is, indeed, one of the many diagnostic symptoms of the disease. Thomas claims that, whereas in scarlatina only the posterior parts of the throat are attacked, in rubella the anterior are affected as well. In most of the cases included in this article the throat exhibited a diffuse, even redness, either limited in extent or wide-spread. In a few instances, however, an eruption of small, yellowish-red or brownish-red spots, of pin-head size, was

visible over the soft palate and uvula and the inner surfaces of the cheeks. A similar appearance has been described by Emminghaus, Nymann, Gerhardt, Picot, Parke, Dunlop, Kassowitz, Cuomo, and others. Mettenheimer mentions only the evenly diffused redness; Thomas says he has never seen a true punctate eruption in the throat and oral cavity; and Klaatsch claims that it does not occur.

Hoarseness is sometimes present, according to various authors (Thomas, Emminghaus, Edwards, etc.). I can report its presence in some cases, and it has been described as often severe by Aitken, Cheadle, Paterson, and others.

The *duration* of the catarrhal and anginose symptoms already described is said by Thomas to be coequal with that of the eruption. They diminish in intensity as the latter fades. This rule seems to me usually to hold good, though in some instances I have observed entire cessation of the symptoms after twenty-four hours, while the rash had faded but slightly. Emminghaus thinks the symptoms diminish with the temperature rather than keep pace with the eruption.

Squire states that an increase of the catarrhal symptoms sometimes takes place as the eruption disappears. Liveing says the sore throat is apt to persist after the rash has faded. In one of the cases under the care of Dr. Shoemaker, and reported here, sore throat continued for eighteen days from the first appearance of the eruption. I have frequently noticed that the cough lasts after the patient seems in other respects well.

Fever is an important accompaniment of the eruptive stage, concerning which there is much contradictory evidence. As already stated, slight fever may attend the stage of invasion, and, according to Eustace Smith, this is not increased on the appearance of the rash; Roberts and others say it diminishes. Careful daily records were made in the eruptive stage in a large number of the cases reported here, and the results show that some elevation of temperature was almost always present. This was greatest usually upon the first, often on the second, day of the eruption, and subsided gradually with it. The fever ranged up to 103°+ F., although it rarely exceeded 101° or even reached this figure. In a considerable number of cases an elevation of temperature—99.5° to 100°—continued, even after the rash had entirely vanished. Possibly a persisting bronchitis was

the cause of this in some instances. In very many cases the temperature fell abruptly to the normal on the second day, while the rash was still at its height or had faded but little. In a few instances in which there had been no fever a slight rise in temperature began when the rash was nearly gone. No cause for this could be detected. It seems to be analogous to the late development of catarrhal symptoms described by Squire and already mentioned. This author says, too, that the temperature is easily disturbed in the week following the disappearance of the eruption.

Thomas describes the same varying temperature, stating that there may be no elevation at all, or that the curve may fall suddenly or slowly at any time in the disease. Hardaway says that the disturbance of the temperature, if present, is usually limited to the first few hours of the eruption, but that it may continue unabated until the end of the disease. Emminghaus writes that in many cases and epidemics the temperature is not above normal; and in those patients who exhibit fever we find either an initial temperature becoming normal before the disappearance of the eruption, or a continued elevation of temperature throughout its entire duration. Squire claims that the fever subsides with the rash on the third day. Reed says it is never over 101° F., and always falls on the second day; Alexander and Cuomo, that the prodromal fever diminishes when the eruption appears; Burnie, that it rarely exceeds 102°; Vogel, Wunderlich, Earle, and Picot, that there is usually no fever; and J. L. Smith, Barthez and Rilliet, Claussen, Parke, Bourneville and Bricon, and Tonge-Smith, that it is slight if present. The writer last mentioned also states that it disappears before the rash fades. Cotting claims that the temperature is highest when the eruption first develops; Kassowitz, that it vanishes by the second or third day; Klaatsch, that it is slight, and lasts but one day.

Some writers, however, consider fever a much more prominent symptom. According to McLeod, it ranges from 100° to 105°; E. L. Fox says it is rather high for the first two days; Edwards reports it as often 103° to 104°; Paterson states that the temperature is high; and Cheadle reports an epidemic in which it reached 103° at the beginning of the eruption, and increased to 104° to 105° as this developed. These so numerous conflicting statements by different writers form but an ad-

ditional proof of the variability of the temperature in rubella.

In the cases reported here the amount of catarrh and fever was usually found to be in direct proportion to the extent and intensity of the eruption. This rule seems to express the opinion of most writers. Yet the greatest elevation of temperature and the fullest development of the eruption, either generally or upon any one part of the body, were not necessarily attained at the same time. Emminghaus claims that they never come together; and Thomas, that they have no connection with each other, as is the case in measles. There were, too, a certain number of patients in which this rule did not hold good. In some of these there was considerable fever and but little rash; in others, a wide-spread eruption with complete apyrexia. The same exception was sometimes found in the relation between the catarrhal symptoms and the eruption. Reed, indeed, claims that the symptoms are not in proportion to the development of the rash.

The *pulse* and *respiration* in rubella are not often increased more than is in accord with the elevation of temperature. I have observed a pulse-rate of about 150 in 2 instances. Paterson and Cheadle speak of the pulse as rapid.

The condition of the *tongue* is a most important one for diagnostic purposes. I have never seen the "strawberry" or the "peeled" tongue in this disease. It was always either clean or covered with a thin, yellowish-white coating, through which the slightly enlarged papillæ near the tip sometimes projected.

This is the condition described by so great a majority of writers that discussion is almost precluded. It may safely be considered a characteristic of the disease. Yet it is but right to state that a different condition has sometimes been reported. Hemming agrees with Balfour and Tripe in describing the tongue as more or less dirty; then developing the "strawberry" appearance, and finally becoming smooth. Murchison says it may exactly resemble the tongue of scarlatina. Burnie makes the presence of the "strawberry" condition one of the diagnostic symptoms which distinguish rubella from measles. Alibert says the tongue is red and slimy. Tompkins reports a patient who had already had measles, developed rubella with a typical "strawberry" tongue, and later suffered from scarlatina. All such cases must be considered, at least, in the highest degree anomalous.

One of the most characteristic symptoms of rubella is the *enlargement of the lymphatic glands* behind the ear and back of the sterno-cleido-mastoid muscle. Maton in 1815 observed them, and remarked their importance. While describing the features which distinguish rubella from the roseola of Willan he says, "besides, tumours do not occur in roseola."

It is safe to say that this glandular enlargement is present in almost every case. Hardaway has not found it absent in a single instance. J. F. Meigs[1] looked upon the enlarged post-auricular gland as one of the most prominent diagnostic signs of rubella. Squire, Hardaway, and Thierfelder say it may often be detected before the rash becomes visible. The very constant occurrence of this symptom is further testified to by Gerhardt, Mettenheimer, Douglas, Earle, Emminghaus, Tonge-Smith, Edwards, Duhring, and many others.

Eustace Smith, however, only states that it is present in some epidemics; and Kassowitz discovered it in only one-third of his cases, but noticed that it was the last symptom to disappear. The presence of this glandular swelling, with its very early appearance and long continuance, has recently had even greater stress laid upon it by writers in the English journals. Glover, Jalland, and Strover report instances in which it even accompanied the stage of incubation; and Squire reiterates his former statement to this effect.

I have rarely failed to detect the enlargement of one or more glands. Though not perceptible on the first day in some cases, it became clearly so on the second. The tumefaction lasted a variable time, often continuing after the rash had quite disappeared.

I must state, however, that I have repeatedly detected a similar enlargement in measles, and believe it would be oftener found if oftener sought for.

The occasional occurrence of enlargement of the glands of other parts of the body is mentioned by Thomas, Klaatsch, Hardaway, Tonge-Smith, and Emminghaus. The latter writer even includes it among the prodromes. In the severer cases of those reported here, Dr. Musser frequently detected a tumefaction of the axillary and, especially, of the inguinal glands.

Œdema of the face accompanying the eruption is referred to by Douglas. It was present in a number of my cases.

---

[1] Personal communication.

An *odor* has been said by Heim to attend the eruption. He claims that it is the same as in scarlatina, while Squire writes that it often smells like measles. I have found no other reference to it.

Itching is sometimes an attendant on the rash. It is mentioned by the older writers, and by many of the more modern (Vogel, Thomas, Mettenheimer, Maton, Bourneville and Bricon, Hardaway, Edwards, Emminghaus, etc.). The general opinion is, that it is absent in the greater number of cases.

A peculiar *roughness of the skin*, giving a sensation to the hand much like that produced by *cutis anserina*, was noticed very frequently by Drs. Shoemaker and Musser and by myself. This not only accompanied the rash, but persisted, often, days after all redness had disappeared. I find very little attention called to this very common symptom, though Golson and a few others refer to it.

Nausea and vomiting are usually considered to be among the rarest of symptoms. Bourneville and Bricon have seen vomiting in but one case. Paterson and Aitken state that it sometimes occurs; Kingsley and Cheadle, that it is seen in severe cases. Parke and McLeod consider nausea and vomiting very rare; but J. L. Smith thinks them common. Edwards, too, mentions vomiting as frequent, and in five cases as almost uncontrollable. In a very few of the severest cases included in this report it was observed upon the first day of the eruption.

The *bowels* are regular or confined.

DESQUAMATION.—As the red color of the eruptiom disappears, I have often seen spots of a faint brownish or yellowish color remaining, which in a short time vanished in their turn. This appearance has been observed by many writers. Cheadle, Thomas, and Edwards speak of a very delicate, fleeting yellow tinge. Kassowitz describes a marbling of the skin persisting for six to eight days after recovery. Rilliet and Barthez report delicate yellowish spots; Emminghaus, an indistinct cloudy pigmentation; and Stone, a staining of the face lasting two or three days.

There may or may not occur a slight branny desquamation, following almost immediately the disappearance of the eruption. It was present in a large number of the cases reported here. It has never been observed by Thomas, Steiner, Fleischmann, Brodie, McLeod, Wilson, Goodhart, Cuomo, or Bourneville and Bricon. Other writers whom I have consulted say, almost without ex-

ception, that it is slight, and always furfuraceous, but is often wanting. Aitken and Paterson state that the scales on the soles and palms are larger than elsewhere, but never so large as in scarlatina.

Desquamation is usually completed in from *one to three* days. Occasionally it lasts a longer time; and, according to Squire, may persist until the third week. Edwards has seen it continue twenty days. Scholl claims that he has seen it last until the fortieth or fiftieth day. Hemming, Paterson, Aitken, and Edwards describe it as beginning in the centre of a patch and extending toward the periphery. The latter also states that the buccal cavity takes part in the desquamation.

Complications and Sequelæ.—Those who (as Goodhart) have described the disease in its very lightest form state that there are none, and this is certainly true in the vast majority of cases. Other writers have reported very various morbid conditions attending or following rubella. The most common affections are those of the respiratory apparatus. Severe bronchitis and pneumonia are mentioned by Emminghaus, Cheadle, J. L. Smith, Earle, Parke, and Edwards. Ryle and Edwards each saw pleurisy once. Tonge-Smith describes a secondary sore throat, appearing on the third or fourth day, and accompanied by high fever and much swelling, but never by sloughing. Severe sore throat is also reported by Emminghaus among others. Eustace Smith makes the secondary throat affection a characteristic of rubella. A membranous deposit upon the tonsil is reported by Cheadle, and embarrassed and stridulous respiration by him and by Glaister. According to Parke and Slagle, croup was sometimes present, and the former says marked adenopathy in the cervical region and under the tongue occurred in a large number of cases. Diphtheria was observed by J. Lewis Smith. Mettenheimer reports nasopharyngeal catarrh, inflammation of the mucous membrane of the mouth, and permanent enlargement of the tonsils as sequelæ. The rare occurrence of albuminuria and the dropsy attending it is a disputed point. It is mentioned by Emminghaus; and Kingsley, Cheadle, Duckworth, and Reed each report 1 case. Hatfield found slight albuminuria in 2 cases; and Cuomo, in 3. Liveing says it is not infrequent; and Edwards, that it was present in thirty per cent. of his cases. Roberts claims that transient albuminuria is not uncommon, but that true renal disease is very rare.

On the other hand, Mettenheimer and Squire say it never occurs ; Tonge-Smith has never seen it ; and Hardaway writes, "it would be safe to say that such cases are entirely anomalous, if not, indeed, in some instances examples of mistaken diagnosis." With this statement the mass of observers will, I think, concur.

The occurrence of intestinal catarrh must be considered a most unusual complication. Vineyard says there is constipation, sometimes followed by severe diarrhœa ; and McLeod, that diarrhœa is rare. Tompkins reports one case in which the bowels were loose ; Balfour considers catarrh of the colon a common symptom. Gastro-intestinal irritation is mentioned by Emminghaus, and reported by Earle in 3 or 4 cases ; but Edwards states it was present in forty per cent. of his. He also reports 10 cases of enteritis, and 2 of entero-colitis. In the description of an epidemic, almost as severe as that of Edwards, Cheadle considers the absence of intestinal catarrh characteristic of rubella, and as distinguishing it from measles. Cuomo found diarrhœa frequent in a series of cases which he himself calls in all respects very anomalous. The majority of writers make no mention of the state of the bowels, having evidently found nothing to note. Stomatitis is reported by Hatfield in 2 cases, and by Edwards in 4 ; aphthæ, by the latter and by Earle. Erysipelas was a sequel in several cases according to Alexander. One patient of J. L. Smith developed varicella. Hardaway has seen otorrhœa and ciliary blepharitis follow ; and Cordell, typhoid fever, but hardly calls it a sequel. De Schweinitz has noted 2 cases of phlyctenular keratitis. Curtman saw abscesses form in different parts of the body ; and Golson, in the submaxillary lymphatic glands. Rheumatism developed in a few of Earle's cases, in 2 of Edwards', and in 1 of Slagle's. Urticaria was observed by Slagle, Earle, and Cullingworth. Golson reports a feeling of numbness following desquamation, and claims that abolition of voluntary motion in the arms and legs sometimes occurs and lasts for several days. Slagle has observed a painful enlargement of the thyroid gland in 6 instances. Thierfelder describes an œdema of the face, and Emminghaus a similar condition of the legs as a sequel. Cheadle found earache often develop, as the rash subsided. Convulsions and delirium are reported by Aitken, Paterson, and others of the writers of that time.

Among the 150 cases reported here but few complications or sequelæ were seen. Pneumonia developed in 2 cases under my care—in the one upon the fourth day, and in the other on the seventh day, after the appearance of the rash. Urticaria complicated the disease in 1 case of Dr. Musser's, and icterus followed in another. In several cases which had very recently been vaccinated rubella seemed to run an unusually severe course. In 1 of the patients treated by Dr. Shoemaker diarrhœa occurred on the day before the rash developed, but ceased before the latter appeared.

None of the complications or sequelæ which have been described by writers are seen except with the greatest rarity.

Relapse.—Most writers do not mention the possibility of relapse, and I have found none dispute its rarity except Kingsley and Cuomo. The former says it occurs frequently, and the latter saw it in every one of the 90 anomalous cases which he reports. It was witnessed seven or eight days, on the average, after the beginning of the disease, and was ushered in by similar but less intensely severe prodromal symptoms. Emminghaus says relapse occurs but seldom, and takes place immediately after the disease is over, or after an interval of about two weeks. He saw it in 3 cases. Earle records it in 2 instances; Edwards, in an equal number—in one case on the fourth, in the other on the twentieth, day; Golson, in 1 case on the seventh day. Köstlin and Lindwurm have also reported cases. Three of the cases reported in this paper suffered relapse. These were children under the care of Dr. Musser, and had all had rubella badly. In the first and second cases the rash reappeared, with a renewal of the catarrhal symptoms, three weeks after the onset of the disease, and in the third patient after an interval of eleven days.

Prognosis; Mortality; Treatment.—As a rule, rubella is a disease of no danger whatever. This is the opinion of by far the greater number of writers. Squire says, "Where a mortality is reported as high as three per cent. of those attacked, measles is present." Yet severe cases and epidemics do occur, and deaths, usually from the complications, do take place. A few of the purely uncomplicated cases reported here were sick for several weeks from the depressing effect of the disease itself. The older English writers, as Paterson, Copland, and Aitken, thought the prognosis must be guarded, and

that death frequently occurred. Edwards reports seven deaths (4.25 per cent.), and Hatfield a mortality of 9 per cent. I have also found fatal cases published by Alexander, Hemming, Slagle, Roberts, and Cuomo. In one case of Balfour's the child died of croup before the rash appeared. McLeod says the mortality is trifling. Several cases died in Toronto in an epidemic in 1882. Treatment, except hygienic, is rarely needed. A light diet should be given ; confinement to bed enjoined for a few days, if there is fever, and to the house for a week or longer. All chilling of the body is to be avoided, and severe symptoms or complications treated as they develop.

Conclusions and Diagnosis.—The mystification which surrounds rubella, the confusion into which contradictory statements have plunged the subject, are, I think, explainable on the following grounds :

1. Rubella is liable to wide variation, and anomalous cases and epidemics occur, as in other specific febrile diseases.

2. As described by the older writers, it certainly differed greatly, if not totally, from the disease as it now exists.

3. There has been a disposition shown by many modern writers to describe their cases or epidemics as necessarily representing the typical form of the disease.

4. Errors in diagnosis are easily made, and descriptions of genuine cases are sometimes very faulty.

In order, then, to draw from the mass of published matter any conclusions, or to formulate any description of the disease which may be generally applicable, some accounts must be entirely ignored, and all reported cases carefully weighed and balanced. In considering, for example, the severe epidemic reported by Edwards, it must be remembered that an epidemic of measles was prevailing in the hospital at the same time. And it must be taken into consideration whether the opinion of Jacobi and of West may not perhaps be correct as expressed at the International Congress of 1881—viz., that rubella prevailing simultaneously with measles or scarlatina may be influenced by it, and may take on symptoms not belonging to itself. This is the view of Hatfield regarding the severest of his 110 cases. The cases reported by Cheadle were also very severe, and must be considered wholly anomalous ; and Cuomo entertains this opinion of his own graver cases. On the other

hand, Thomas, Squire, and some others describe rubella in its very mildest form, and it would be a mistake to suppose that it must always exhibit just such symptoms. The following condensed description of the disease is the result of an attempt to thus combine the careful study of the cases reported here with the analysis and comparison of the numerous published accounts consulted.

Rubella is an acute, specific, epidemic, and contagious febrile disorder, occurring but once in the same individual, and entirely independent of both measles and scarlatina. It is a disease of childhood, although adults and infants do not always escape. The incubation is of very variable length, lasting one to three weeks. Prodromes are usually absent or slight, continuing rarely more than twelve hours, and consist of malaise, drowsiness, slight catarrhal symptoms, slight sore throat, sometimes fever and enlargement of the glands, and occasionally nausea. The eruption is maculo-papular, pin-head to split-pea size, pale-rose, multiform, usually discrete, sometimes grouped as in measles, sometimes confluent as in scarlatina. It appears first on the face, and spreads rapidly to the body, persisting in all about three or four days. It either reaches its maximum successively on different parts, and fades from each rapidly, or it is at its height everywhere at once upon the second day. The symptoms of this stage are those of measles, but very much less severe, and perhaps entirely wanting, combined with more or less sore throat and enlargement of the glands at the back of the neck. The temperature is very variable—often not elevated, rarely exceeding 101°, often falling to normal on the second day, but frequently persisting a much longer time. Desquamation is absent, or slight and branny. Complications and sequelæ are rare. The prognosis is favorable, and treatment not often needed. Cases of a much graver type are sometimes seen, in which the symptoms are much exaggerated; and death may occur, usually from some complication.

Diagnosis.—The more important diagnostic points are the short duration and slight import of the prodromes, the absence or slight degree of the catarrhal symptoms, the slight degree of fever and its variability, the presence of more or less sore throat and of enlarged lymphatic glands at the back of the neck and behind the ears, and the occurrence of cases in epidemics. As already emphasized, it is frequently impossible to diagnose sporadic cases if at all abnormal. For convenience of reference,

a table of well-recognized diagnostic symptoms distinguishing rubella from measles and from scarlatina is appended. This cannot be claimed to be complete, inflexible, or applicable to anomalous cases. In tabulating the symptoms of measles and scarlatina, the articles in Ziemssen's and Gerhardt's "Cyclopædias" and in Pepper's "System of Medicine" have been principally consulted.

TABLE FOR DIFFERENTIAL DIAGNOSIS.

RUBEOLA.	RUBELLA.	SCARLATINA.
	Incubation.	
Fourteen days.	Very variable; one to three weeks.	One to seven days.
	Prodromal Symptoms.	
Usually last three days.	Absent, or seldom longer than twelve to twenty-four hours.	Last twenty-four hours or less.
Severe catarrhal symptoms of nose and eyes; considerable cough.	Catarrhal symptoms, if present, usually slight.	
Slight sore throat not uncommon.	Sore throat often attends.	Marked sore throat.
Vomiting occasionally.	Vomiting very rare.	Vomiting a frequent symptom.
Decided fever, with a characteristic temperature-curve.	Fever absent or slight.	High fever; rapid pulse; marked nervous symptoms.
	Eruption.	
First on the face.	First on the face.	First on the neck and chest.
Spreads gradually; maximum all over body by second or third day.	Spreads very rapidly; either fading from one part before in full bloom on another, or with universal maximum in twenty-four hours.	Spreads slowly; maximum reached by fourth day.
Lasts average of four days.	Lasts three to four days or less.	Usually lasts six to seven days or longer; sometimes much less.
Color deep red; often purplish.	Color usually pale rose-red.	Color intense red; dusky or livid in some cases.
Papular; arranged in irregular or crescentic groupings.	More or less elevated; spots smaller than in measles; discrete or confluent; seldom arranged in groupings.	Minute red points confluent in large patches or universally.

RUBEOLA.	RUBELLA.	SCARLATINA.
	Symptoms of Stage of Eruption.	
Severe catarrhal symptoms persist and increase; severe bronchitis common.	Slight catarrhal symptoms persist or may appear.	Coryza in bad cases.
Throat sometimes sore.	Slight sore throat nearly always present.	Sore throat a very marked and constant feature.
Glands sometimes enlarged as in rubella.	Glands behind ear and at back of neck almost always enlarged.	Glands below jaw often much enlarged.
Tongue coated; in bad cases dry and brown.	Tongue clean or with thin yellow coat; *never "strawberry" or "peeled."*	Tongue "strawberry," and later denuded.
Temperature 102–104°; ascends slowly; maximum with that of eruption.	Temperature variable; rarely over 101°; no constant connection of maxima of temperature and eruption; often normal by second day.	Temperature usually 104–105° from outset for three to four days.
	Pulse in proportion to fever.	Pulse very rapid.
Diarrhœa usual during eruption.	Almost never diarrhœa.	
Albuminuria not very common.	Albuminuria exceedingly rare.	Albuminuria a common occurrence.
	Desquamation.	
Branny.	Absent, or slight and branny.	In flakes or rolls.

BIBLIOGRAPHY.

Aitken: Sci. and Pract. of Med. (3d Amer. ed., 1872), i., p. 454.
Alexander: Can. Journ. Med. Sci., 1882, p. 297.
Alibert: Monogr. des dermatos. Paris, 1832.
Balfour: Edinb. Med. Journ., 1856–57, p. 717.
Bartholow: Pract. of Med. (2d ed., 1886), p. 778.
Beall: Med. and Surg. Reporter, 1886, lv., p. 419.
Bourneville et Bricon: Prog. méd., 1884, 520, 566.
Brenchley: Lancet, 1870, ii., p. 713.
Bristowe: Pract. of Med. (Amer. ed., 1876), p. 153.
Brodie: Mich. Med. News, 1881, iv., p. 200.
Brown, F. M.: Brit. Med. Journ., 1880, ii., p. 9.
Brown, W. P.: Brit. Med. Journ., 1880, ii., p. 49.
Burnie: Brit. Med. Journ., 1880, i., p. 848, and ii., p. 126.
Byers: Brit. Med. Journ., 1881, ii., p. 76.
Cheadle: Transac. Internat. Med. Congr., 1881, iv., p. 4.
Claussen: Chicago Med. Rev., 1881, iii.–iv., p. 212.
Collin: Schmidt's Jahrb., 1852, lxxvi., 66.
Conby: France médicale, 1886, i., p. 457.
Copland: Dict. of Pract. Med., 1858, iii., p. 655.
Cordell: Maryland Med. Journ., 1886, xv., p. 101.
Cotting: Bost. Med. and Surg. Journ., 1873, ii., p. 485.

Cullingworth: Brit. Med. Journ., 1883, ii., p. 1234.
Cuomo: Gior. internaz. d. sc. med., Napoli, 1884, vi., 529.
Curtis: Med. Ann., Albany, 1881, ii., p. 78.
Curtman: St. Louis Cour. Med., 1880, iii., p. 531.
Da Costa: Med. Diag. (4th ed.), p. 759.
Davis: Brit. Med. Journ., 1880, ii., p. 507.
Day: Dis. of Child. (2d ed., 1881), p. 98.
Descroizilles: Path. et Clin. infant., 1883, p. 774.
D'Espigne: Jaccoud's Dict. de Méd., 1882, xxxii.
Delastre: Contrib. à l'étude de la Rub. 1883.
Dixon: St. Louis Cour. Med., 1881, iv., p. 200.
Donovan: Dubl. Journ. Med. Sci., 1880, lxx., p. 447.
Douglas: Lancet, 1877, i., p. 784.
Duckworth: Lancet, 1880, i., p. 395.
Duhring: Phila. Med. Times, 1881, p. 395.
Dukes: Lancet, 1881, ii., p. 743.
Dunlop: Lancet, 1871, ii., p. 464.
Earle: St. Louis Med. and Surg. Journ., 1881, xli., 392.
Editorial in Can. Journ. Med. Sci., 1882, p. 205.
Edwards: Amer. Journ. Med. Sci., 1884, 448.
Eichhorst: Path. u. Therap., 1885, iv., 192.
Emminghaus: Gerhardt's Handb. d. Kinderkr., 1877, ii., 334.
Erskine: Lancet, 1880, ii., p. 452.
Fielitz: Hufeland's Journ., 1797, iv., 199.
Filatow: Archiv f. Kinderheilk., 1885–86, vii., 241.
Flint: Pract. of Med., 1886, 1072.
Foss: Edinb. Med. Journ., May, 1872.
Fothergill: Sore Throat. 1754.
Fox: Med. Times and Gaz., 1870, p. 360.
Gerhardt: Lehrb. d. Kinderkr., 1881, iv., 81.
Glaister: Transac. Internat. Med. Congr., 1881, iv., p. 31.
Glover: Lancet, 1886, i., p. 785.
Golson: Transac. Med. Assoc. Alabama, 1883, p. 424.
Goodhart: Diseases of Child., 1885, p. 203.
Gowers: Lancet, 1880, ii., p. 169.
Hardaway: St. Louis Cour. Med., 1881, p. 83; also, Pepper's Syst. of Med., i., p. 583.
Harrison: Virgin. Med. Monthly, 1882–83, ix., p. 261.
Hartshorne: Med. and Surg. Report, 1881, xlv., p. 81.
Hatfield: Chicago Med. Exam., August, 1881; also, Archives for Pediat., 1884, p. 614.
Heim: Hufeland's Journ., 1812, iii., 61.
Hemming: Edinb. Med. Journ., 1880, xxvi., p. 52.
Henderson: St. Louis Cour. Med., 1880, iii., p. 534.
Henoch: Kinderkrankheiten, 1883, 646.
Hewlett and Bridgewater: Lancet, 1861, i., 493.
Hibbard: Cincin. Lanc. and Observ., 1874, p. 728.
Jacobi: Transac. Internat. Med. Congr., 1881, iv., p. 32.
Jalland: Lancet, 1886, i., p. 855.
Jones: Bost. Med. and Surg. Journ., 1881, cv., p. 607.
Kaposi: Hautkrankheiten, 1883, 198.
Kassowitz: Transac. Internat. Med. Congr., 1881, iv., p. 10.
Kingsley: St. Louis Cour. Med., 1880, p. 21.
Klaatsch: Zeitsch. f. klin. Med., B. x., H. 1, 1.
Kollock: N. Carol. Med. Journ., July 5, 1882.
Ladell: Brit. Med. Journ., 1881, ii., p. 193.
Lawrence: Brit. Med. Journ., 1882, i., p. 780.
Liveing: Lancet, 1874, i., p. 360.
Longhi and Tirinanzi: Dizion. d. term. ant. e mod. in d. sci. med. e veterin., 1882, ii.
Loving: South. Med. Rec., 1881, xi., p. 251.
Maton: Med. Transac. Col. of Phys., London, 1815, v., p. 149.
McLeod: Brit. Med. Journ., May 14, 1885; also, Archives for Pediat., 1885, p. 499.

Mettenheimer: Journ. f. Kinderkr., 1869, liii., 273.
Murchison: Lancet, 1870, ii., p. 595.
Oxley: Transac. Internat. Med. Congr., 1881, iv., p. 31.
Park: Chicago Med. Journ. and Exam., 1881, xliii., p. 130.
Paterson: Edinb. Med. and Surg. Journ., 1840, p. 381.
Picot: Jaccoud's Dict. de Méd., 1882, xxxi., p. 774.
Pollock: Lancet, 1877, i., p. 681.
Radcliffe: Phila. Med. Times, 1879, x., p. 597.
Rayer: Malad. de la Peau., 1826, i., p. 42.
Raymond: Prog. méd., 1881, December 16.
Reed: Phila. Med. Times, 1883, November 14.
Riggs: Virgin. Med. Month., 1879, p. 589.
Rilliet et Barthez: Malad. des enfants, 1861, iii., p. 260.
Roberts: Pract. of Med. (5th Amer. ed., 1884), p. 164.
Roberts, D. J.: South. Pract., 1885, vii., p. 402.
Robinson, J.: Brit. Med. Journ., 1880, i., p. 922.
Robinson, P. G.: St. Louis Cour. Med., 1881, vi., p. 83.
Rooke: Brit. Med. Journ., 1880, ii., p. 126.
Ryan: Austral. Med. Journ., 1883, p. 200.
Ryle: Brit. Med. Journ., 1886, ii., p. 160.
See: Prog. méd., 1881, ix., p. 987.
Selle: Rudimenta pyrotologiæ methodica. 1787.
Shackelton: Brit. Med. Journ., 1883, ii., p. 799.
Sholl: Transac. Med. Assoc. Alabama, 1881, p. 528.
Shuttleworth: Brit. Med. Journ., 1880, ii., p. 49; also, Transac. Internat. Med. Congr., 1881, iv., p. 21.
Slagle: Transac. Minnesota Med. Soc., 1881, p. 204.
Smith, Eustace: Diseases of Child., 1884, p. 31.
Smith, J. Lewis: Diseases of Child., 1879, p. 191; also, Transac. Internat. Med. Congr., 1881, iv., p. 14.
Squire: Transac. Internat. Med. Congr., 1881, iv., p. 27; also, in Quain's Dict. of Med. (9th Amer. ed., 1885), 1382; Lancet, 1886, i., 1047; Bulkley's Arch. of Derm., 1882, p. 221.
Steeves: Brit. Med. Journ., 1884, i., p. 225.
Stewart: Transac. Internat. Med. Congr., 1881, iv., p. 33.
Stone: Med. and Surg. Report., 1881, xliv., p. 482.
Strover: Lancet, 1886, i., p. 951.
Sweetnam: Can. Journ. Med. Sci., 1882, p. 111.
Tanner: Pract. of Med. (Amer. ed., 1864), p. 192.
Thomas: Rev. des Sci. méd., January, 1873; also, in Ziemssen's Cyclop. Pract. Med. (Amer. ed., 1875), ii., p. 129.
Tonge-Smith, W.: Lancet, 1883, i., pp. 994, 1036; also, 1886, i., p. 998.
Tripe: Med. Times, 1852, v., 457.
Trousseau: Clin. Med. (New Syden. Soc.), 1869, ii., p. 236.
Veale: Edinb. Med. Journ., 1866, p. 404.
Vogel: Lehrb. d. Kinderkr., 7 Auf., 450.
Wagner: Hufeland's Journ., 1834, lxxix., 35.
Watson: Pract. of Med. (4th ed.) 1857.
West: Transac. Internat. Med. Congr., 1881, iv., p. 34.
Wieger: Cours de Path. int., 1865.
Wilson: Brit. Med. Journ., 1880, ii., p. 37.